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COMPARATIVE EFFECTS OF AN EXPERIMENTAL AND A CONVENTIONAL SEED COTTON DRYING SYSTEM ON COTTON FIBER PROPERTIES

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SUMMARY

The Stanford Research Institute developed a controlled-humidity drying system that was designed to dry seed cotton by using conditioned air of moderate temperature. To evaluate this drying system, a ginning-spinning study, utilizing 48 bales of cotton, was designed. The seed cotton was divided into two series—Series C and Series M. Series C, comprising 24 bales, was subdivided into four groups having initial moisture contents of 7, 9, 11, and 13 percent. This seed cotton was dried so that the final lint moisture at ginning was about 6 percent. Series M had an initial moisture content of about 9 percent. Target levels for final lint moisture of this series were 3, 5, and 6 percent.

For both series of cottons, parallel drying tests were run with an experimental and a commercial drier. For Series C cotton, the final lint moisture content of 6 percent was obtained when the seed cotton was dried by either system. However, due to technical difficulties, the final lint moisture levels of 3, 5, and 6 percent were not obtained when Series M seed cotton was dried. Therefore, the only variable considered for Series M cotton was type of drier.

The differences between the fiber properties as affected by the two drying systems were small and inconsistent. Only at the 13-percent moisture level of Series C cotton were any of these differences shown to be statistically significant. The differences were in favor of the experimental drier but were very small, being 0.02 inch in array mean length and 1.2 percent in fibers shorter than one-half inch.

Only at the 13-percent moisture level did the grade index differ significantly. The average grade index of cotton from the commercial drier was 90, and that from the experimental drier was 95. This difference was reflected in a significantly higher percentage of total picker and card waste removed from cotton dried with the commercial drier at this moisture level.

For Series C cotton at the 13-percent moisture level, lint dried by the commercial drier produced significantly higher ends down per 1,000 spindle hours (EDMSH) than did lint dried by the experimental drier. For the other moisture levels, differences in EDMSH between driers were not significant.

For the experimental drier, the reduction of initial seed cotton moisture had no consistent effect on EDMSH, but for the commercial drier, the reduction of initial seed cotton moisture caused a significant reduction in EDMSH.

For Series M cotton, yarn spun from lint dried with the experimental drier produced 42 EDMSH, while yarn spun from lint dried by the commercial drier produced 45 EDMSH. This difference in ends down was not statistically significant.

No unqualified conclusion can be drawn from the results of this study concerning the practicality of further development of the new drying system. First, differences were found only at the high-moisture level of Series C cotton. Second, the experimental drier was not incorporated as a part of a commercial ginning setup. Finally, relevant factors other than quality and performance of cotton from the two driers were not considered.

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COMPARATIVE EFFECTS OF AN EXPERIMENTAL AND A CONVENTIONAL SEED COTTON DRYING SYSTEM ON COTTON FIBER PROPERTIES

By Edward H. Shanklin, Konrad Semrau, and Preston E. LaFerney[1]

Over the past 10 to 15 years, numerous ginning-spinning studies have been made to determine the effects that harvesting, seed cotton drying and cleaning, lint cleaning, and the interaction of these variables have on spinning performance and yarn quality (*1*, *4*, *5*, *6*, *8*).[2] These studies have shown that excessive drying of seed cotton adversely affects fiber length and length distribution, and this, in turn, affects spinning performance and yarn quality.

For a number of years a lint moisture range of 5 to 7 percent (*3*, *9*) was the recommended level to secure proper cleaning and ginning without loss of fiber quality. More recently, a lint moisture content of 6½ to 8 percent (*2*) has been recommended.

In 1961 Stanford Research Institute began the development of a throughflow, controlled-humidity, drying system for seed cotton (*7*). This system is designed to dry cotton uniformly to a predetermined moisture content without using an air temperature high enough to damage the cotton. Laboratory development of the process was carried out with the support of the J. G. Boswell Company and the Institute's agricultural research center. Subsequently, a pilot-plant investigation was conducted with the support of the Foundation for Cotton Research and Education of the National Cotton Council, the J. G. Boswell Company, the Continental Gin Company, and the cooperation of the Agricultural Research Service and the Economic Research Service of the U.S. Department of Agriculture.

The objective of this phase of the study was to determine the effects that the two drying systems had on fiber and yarn properties, and spinning performance.

This report deals with results obtained from fiber and spinning tests of experimental lots of cotton by the Cotton Quality Research Station of the Agricultural Research Service, U.S. Department of Agriculture, Clemson, S.C.

PROCEDURE

Ginning

Detailed descriptions of the harvesting and ginning procedures, the drying systems, and the processing organization by the pilot spinning plant are given in the appendix.

The cotton used in this study consisted of 48 bales of California cotton, which were divided into two sets of bales, referred to as Series C and Series M.

Series C consisted of 24 bales of cotton ginned from seed cotton having initial moisture contents of 7, 9, 11, and 13 percent. This seed cotton was dried to a final lint moisture content of about 6 percent. Cotton of each initial moisture level was subjected to parallel drying tests with a commercial drier and an experimental drier. Each test condition was replicated three times.

In all of these tests, the experimental drier was operated with an air temperature of 110° F., and relative humidity of 50 percent. The three-stage commercial drier was operated at such air temperatures as were necessary to reduce the final lint moisture content to 6 percent (app. table 1).

Series M cotton consisted of 24 bales ginned from seed cotton having an initial moisture content of 9 percent. Attempts were made to reduce the lint moisture content to 3, 5, and 6 percent. However, due to technical difficulties, these levels were not obtained. Parallel tests were run with the existing commercial drier and the experimental drier. Each test condition was replicated four times. With the experimental drier, the drying air temperature was, in all cases, maintained at 110° F., but the relative humidity was varied to give the desired final lint moisture content. With the commercial drier, the air temperature was adjusted to give the desired final lint moisture level (app. table 1).

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[1] Mr. Shanklin is a supervisory cotton technologist in the Agricultural Research Service. Mr. Semrau is a senior chemical engineer for Stanford Research Institute. Dr. LaFerney is an agricultural economist in the Economic Research Service.

[2] Italic figures in parentheses refer to items under Selected References, p. 4.

Processing and Testing

All lots were processed separately from opening through spinning, standard processing procedures being used throughout. Detailed procedures are given in the appendix.

The Suter-Webb array, Fibrograph, "0" and one-eighth-inch gage Pressley strength, and Micronaire tests were made on fiber samples taken at intervals throughout each bale. For the 39s yarn spun on each test, yarn size, skein strength, single strand strength, and Uster imperfection determinations were made. All fiber tests, spinning tests, and yarn evaluation tests were performed under controlled atmospheric conditions.

RESULTS

Only the most important and significant findings are discussed in this section. Full details of the statistical analyses and the test results are given in the appendix.

Moisture Levels

Average moisture results for both types of driers and for Series C and M cottons are given in table 1. As noted, the desired moisture levels were not obtained for Series M. Therefore, moisture was not discussed as a variable for Series M cotton. Only a comparison of the two driers is given for this series. The following tabulation shows the average moisture levels obtained:

	Average moisture levels, Series M	
	Experimental drier	*Commercial drier*
	Percent	*Percent*
Feeder apron	8.6	9.4
Lint slide	5.1	5.0

Table 1.—Average moisture results for Series C and M cottons dried by both types of driers

SERIES C

Type of drier [1]	Target initial seed cotton moisture	Actual seed cotton moisture at:		Lint regain [2]	Lint moisture content at: [3]	
		Trailer	Feeder apron		Feeder apron	Lint slide
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Experimental	13	15.4	9.5	6.8	8.5	6.6
Commercial	13	15.2	11.1	7.0	8.0	6.4
Experimental	11	12.5	9.7	6.7	7.0	5.9
Commercial	11	11.3	9.9	6.4	6.7	5.7
Experimental	9	10.7	8.9	6.2	6.5	5.5
Commercial	9	10.7	9.6	6.1	6.7	5.5
Experimental	7	9.3	8.4	5.9	6.2	5.0
Commercial	7	9.2	8.8	6.0	6.5	5.5

SERIES M

Type of drier [1]	Target final lint moisture	Actual seed cotton moisture at:		Lint regain [2]	Lint moisture content at: [3]	
		Trailer	Feeder apron		Feeder apron	Lint slide
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Experimental	3	10.8	8.2	5.6	5.4	4.8
Commercial	3	11.4	8.8	5.7	4.8	4.4
Experimental	5	11.2	8.6	5.9	6.2	5.2
Commercial	5	10.8	9.8	5.9	6.2	5.3
Experimental	6	11.2	9.0	6.0	6.6	5.4
Commercial	6	11.6	9.6	6.0	6.6	5.6

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[1] Experimental and commercial driers.

[2] Regain values determined by the oven method on samples taken at the gin.

[3] Lint moisture content was determined with a conductivity meter.

Classification

Grade index and staple length for cotton used in this study are shown in appendix tables. No consistent trend in these two properties can be attributed to the system used in drying. However, at the 13-percent moisture level for Series C cotton, the grade index was higher for cotton from the experimental drier, averaging 95 for the experimental drier and 90 for the commercial drier.

Series C Cotton

Fiber Length

The average upper quartile length (U.Q.L.) for cotton dried by the experimental and commercial driers, and the different moisture levels are shown in the following tabulation:

Upper quartile length—array

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*Inches*	*Inches*
13	1.19	1.18
11	1.17	1.16
9	1.15	1.16
7	1.17	1.18

For the different initial moisture levels, there was no significant difference in U.Q.L. between driers. Also, the relationship between initial moisture and U.Q.L. was not consistent.

The mean length and the coefficient of variation followed the same trend as did the U.Q.L. (app. table 3).

Short Fibers

The average percent of fibers shorter than one-half inch is shown in the following tabulation:

Percent of fibers shorter than one-half inch—array

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*Percent*	*Percent*
13	8.6	9.8
11	10.3	10.4
9	10.4	10.4
7	10.1	10.5

Initial lint moisture had no significant effect on short fibers. Lint ginned from seed cotton containing 13 percent moisture had 8.6 and 9.8 percent fibers shorter than one-half inch for the experimental and commercial driers, respectively. This difference of 1.2 was significant at the 95-percent level. When the initial seed cotton moisture was reduced, there was a slight increase in percent of fibers shorter than one-half inch.

Fibrograph measurements of length and length uniformity showed the same trend as did the array measurements (app. table 5).

Manufacturing Waste

Averages of the percent of total picker and card waste are shown in the following tabulation:

Percent of total picker and card waste

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*Percent*	*Percent*
13	4.32	5.67
11	3.85	3.86
9	3.65	3.71
7	3.52	3.55

As the initial moisture content was reduced, total picker and card waste was reduced. When the results from different driers were compared, only at the 13-percent moisture level was the difference (1.35 percent) between the two driers significant.

EDMSH

Averages for EDMSH (ends down per 1,000 spindle hours) are shown in the following tabulation:

Ends down per 1,000 spindle hours—39s

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*EDMSH*	*EDMSH*
13	61	87
11	62	74
9	56	63
7	63	63

For the 13-percent initial seed cotton moisture, lint dried by the commercial drier produced significantly higher EDMSH than did lint dried by the experimental drier. For the other moisture levels, there was no significant difference in EDMSH between driers.

The reduction of initial seed cotton moisture had no consistent effect on EDMSH for the cotton dried with the experimental drier. However, a reduction in initial seed cotton moisture caused a significant reduction in EDMSH for cotton dried with the commercial drier.

Break Factor

Averages for break factor are shown in the following tabulation:

Break factor—39s

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*Units*	*Units*
13	2467	2419
11	2396	2365
9	2382	2410
7	2372	2401

For yarn spun from lint dried by the experimental drier, there was a small, but consistent, reduction in break factor with a reduction in initial seed cotton moisture. For the commercial drier, this trend was not consistent.

For two of the four initial moisture levels, cotton from the commercial drier produced yarns with a higher break factor than cotton from the experimental drier. From a practical standpoint, none of the differences between break factors can be considered significant.

Yarn Appearance

The averages of yarn-appearance index are shown in the following tabulation:

Yarn-appearance index

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*Index*	*Index*
13	111	114
11	112	113
9	111	111
7	111	113

Neither moisture nor driers had a significant effect on appearance index.

Yarn Irregularities

The averages for yarn irregularities are shown in the following tabulation:

Irregularity percent coefficient of variation

Initial lint moisture for seed cotton	Series C	
	Experimental drier	*Commercial drier*
Percent	*Percent C.V.*	*Percent C.V.*
13	20.8	20.8
11	21.2	21.0
9	21.4	20.9
7	21.2	20.8

The percent coefficient of variation was not consistently affected by a reduction in initial seed cotton moisture.

Series M Cotton

For this series of cotton, the only properties that were statistically different are shown in the following tabulation:

	Experimental drier	*Commercial drier*
Total picker and card waste (percent)	[1] 3.89	[1] 4.02
Neps/100 square inches card web	[2] 11.9	[2] 11.0
Yarn-appearance index	[2] 106(B)	[2] 109(B)
Neps/1,000 yards of yarn	[1] 352	[1] 298

[1] Significant at 1-percent level.
[2] Significant at 5-percent level.

Even though the analyses showed these differences to be significant, the differences between driers were so small that they were not considered to be of practical significance.

The remaining properties that were tested from this series of cottons are shown in appendix tables 10 and 11. The differences in properties between driers were very small.

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APPENDIX

Harvesting

All test cotton was harvested from a single field of Acala 4–42 cotton. The field was divided into plots, each containing 12 rows. Each plot produced approximately two bales of seed cotton. For parallel tests with the commercial and experimental systems, 12 bales of cotton were required—6 for each system. A sufficient number of mechanical pickers were assembled to pick the 12 bales of cotton from 6 plots in about 45 minutes. In this manner, all the cotton for a given pair of tests could be harvested before a substantial change in its moisture content occurred. To minimize the subsequent gains or losses of moisture, the seed cotton was dumped into trailers lined and covered with tar paper.

The cotton harvested from the six plots was assigned in a randomized manner to the two test lots, one to be dried by the experimental system and one by the commercial system. This procedure minimized the effects of field variation.

Gin System and Commercial Drier

The cotton gin was a modern unit equipped with five 90-saw gin stands having a nominal capacity of 10 bales per hour. All cottons from both series were ginned at the nominal rate. There were three driers, the first and second being counterflow units, and the third a 23-shelf tower drier. Each drier was fitted with an automatic air temperature controller with the sensing thermometer located in the outlet air line from the drier. The airflow in the driers was measured at ambient temperature and without cotton flow, and was 5,260, 4,370, and 5,840 cu. ft./min. in the first, second, and third driers, respectively (volumes measured at 1 atmosphere of pressure and 70° F.).

Appendix table 1 shows the average moisture levels and the average inlet and outlet temperatures used at each stage of drying for the two series of cottons.

The individual lint cleaners in series with the gin stands were bypassed, and only one stage of lint cleaning (by the split-stream lint cleaner) was used. This was done to accentuate any differences that might appear in the cleaning efficiency of cotton dried by the experimental and commercial equipment.

Description of Gin Machinery

1. Feed control.
2. Separator.
3. Drier No. 1—Counterflow.
4. Inclined cleaner No. 1.
5. Drier No. 2—Counterflow.
6. Separator.
7. Impact cleaner No. 1.
8. Drier No. 3—23-shelf tower.
9. Incline cleaner No. 2.
10. Impact cleaner No. 2 and No. 3 (units in parallel).
11. Conveyor—distributor.
12. Extractor—feeders.
13. Five 90-saw gin stands.
14. Individual lint cleaners (one behind each gin stand).
15. Lint flue.
16. Split-stream lint cleaner.
17. Condenser.
18. Lint slide.
19. Baling press.

Thermocouples were installed in the inlet and outlet air streams of each drier, and a hygrothermograph was used to measure the temperature and relative humidity of the ambient air in the gin building.

Characteristics of Experimental Drier

The principles of the through-flow, controlled-humidity drying system are discussed in detail by Semrau (7). Only the principal characteristics are presented here for ready reference.

The experimental through-flow drier was a continuous unit of the traveling-screen type. The packed bed of cotton was formed continuously by feeding seed cotton on to one end of an endless horizontal, moving-screen belt. The drying air was drawn downward through the bed by an induced-draft fan. The rate of travel of the screen belt was so adjusted that the cotton was dried by the time that it reached the end of the belt run. The relative humidity was controlled primarily by recycling the major portion of the air, but final adjustment of humidity was made by steam injection controlled by an automatic

Table 1.—Average moisture levels and drier temperature for commercial driers

SERIES C

Target seed cotton moisture level	Trailer seed cotton moisture	Lint slide moisture [1]	Drier No. 1 temperature		Drier No. 2 temperature		Drier No. 3 temperature	
			Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Percent	*Percent*	*Percent*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*
13	15. 2	6. 4	283	151	247	148	174	111
11	11. 3	5. 7	201	116	166	110	104	77
9	10. 7	5. 5	175	108	143	98	83	70
7	9. 2	5. 5	150	100	61	57	57	57

SERIES M

Target final lint moisture	Actual lint moisture	Trailer seed cotton moisture [2]	Drier No. 1 temperature		Drier No. 2 temperature		Drier No. 3 temperature	
			Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Percent	*Percent*	*Percent*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*
3	4. 4	11. 4	325	166	248	152	223	129
5	5. 3	10. 8	218	125	157	108	96	81
6	5. 6	11. 6	178	110	142	99	79	72

[1] Target lint moisture for Series C cottons was 6 percent.
[2] Target trailer seed cotton moisture for Series M was 9 percent.

humidity controller. Humidity control can be accomplished solely by air recycling, but in the experimental unit, final adjustment by steam injection gave more flexibility.

The seed cotton is formed into a packed bed through which the drying air is drawn by a fan. The resistance of the porous bed to flow of air distributes the air so that it flows through the entire mass of fiber and seeds. Consequently, through-flow of air provides high rates of heat and moisture transfer with relatively small temperature and humidity differentials. Because of its very small diameter, a cotton fiber rapidly comes to thermal and moisture equilibrium with the air stream in contact with it; thereafter, continued contact with the air has no further effect upon the temperature or moisture content of the fiber.

As the air flows through the bed of cotton, successive layers of the cotton are dried. When the entire bed is dried, this condition is detected by the observation that the outlet airstream is at the same temperature as the inlet stream.

Drying

1. *Experimental drier.*—In the drying of cotton with the through-flow unit, the final moisture level was controlled by setting the relative humidity of the drying air, as noted above. Drying was considered complete when this outlet air temperature reached a level about 2° F. or less below the inlet temperature of 110° F.

The cotton was unloaded from the covered trailers and delivered to the drier feeder by a conventional pneumatic unloader. The dried cotton discharged from the drier was transferred into trailers by a belt elevator. The trailers used to receive the dried cotton were lined and covered with tar paper during the interval between drying and ginning.

Drying of cotton with the through-flow unit was carried out in the morning and early afternoon hours. The dried cotton was then moved to the gin, where it was ginned in the normal manner except that no heat was applied to the air in the conventional driers.

During the drying and ginning operations, samples were taken at various points in the systems and accumulated to form composite samples corresponding to each bale of cotton processed. The samples were placed in 1-gallon polyethylene bags, which were sealed with tape. Samples of seed cotton were taken at the trailer before drying, at the discharge of the drier, at the trailer before feeding to the gin, and at the feeder aprons of the gin stands. Samples of lint (two samples for each bale) were taken at the lint slide, and lint moisture determinations were made with a conductivity meter. All measurements of moisture regain were made by the oven method.

2. *Commercial drier.*—As soon as the six bales of cotton, dried with the experimental drier, had been ginned, the corresponding six bales of cotton were dried in the commercial drier. The amount of drying was judged by testing seed cotton at the feeder aprons of the gin stands with the conductivity meter (app. table 1). Allowance was made for the anticipated meter error with trash seed cotton.

Processing and Testing

The bales were delivered to the opening room, and the bagging and ties were removed 24 hours before the cotton was processed through the opening and picking equipment.

All lots were processed separately from opening through spinning, using the following organization:

Opening and picking	14-oz. lap
Carding (9½ lbs./hr.)	50-grain sliver
Two-process drawing:	
Breaker (8 ends-up)	53-grain sliver
Finisher (8 ends-up)	55-grain sliver
Roving	1.10 hank (1.30 T.M.)
Spinning (single creel)	39s yarn, 3.98 T.M., 10,250 r.p.m. spindle speed

A spinning test consisted of spinning a full doff of 39s yarn, which required 10 hours of continuous frame operation and produced a test of 10,080 spindle hours. Ends-down were pieced up and recorded on 15-minute cycles. Yarn size, skein strength, single strand strength, and Uster imperfection determinations were made on all yarns.

All fiber, spinning, and yarn-evaluation tests were performed under controlled atmospheric conditions. The Suter-Webb array, Fibrograph, "0" and one-eighth-inch gage Pressley strength, and Micronaire tests were made on samples taken at intervals throughout each bale.

Statistical Analyses

Series C cotton (7, 9, 11, and 13 percent seed cotton moisture).—The split-plot analysis was used because seed cotton with a certain moisture content was harvested from a given field location and then divided into two groups to be dried with the commercial and experimental driers. Replication differences were removed as a source of variation in spinning by grouping the 24 bales into three groups of 8 bales each before spinning.

In cases where there was a significant drier x moisture interaction, subanalyses were made for each moisture level and for each type of drier.

Series M cotton (3, 5, and 6 percent lint-slide moisture).—The split-plot analysis was used. The 24 bales were harvested on four different days (replication) and the 6 bales in a given rep were assigned to the main plots (type of drier); then the 3 bales in each main plot were randomly assigned to subplot treatments.

In cases where there was a significant moisture x drier interaction, subanalyses were made for each moisture level and for each type of drier.

Because the desired lint-slide moisture levels of 3, 5, and 6 percent were not obtained when this cotton was dried and ginned, moisture was not a significant variable. The results are reported only by type of drier.

Statistical Tables

Table 2.—Grade index and staple length of cotton by drier and moisture level, Series C cotton

Initial lint moisture for seed cotton	Grade[1]		Staple length	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Index*		*Inches*	
13	94	90	$1\frac{1}{16}$	$1\frac{3}{32}$
	95	90	$1\frac{1}{16}$	$1\frac{1}{16}$
	95	90	$1\frac{3}{32}$	$1\frac{3}{32}$
11	96	96	$1\frac{1}{16}$	$1\frac{1}{16}$
	99	97	$1\frac{3}{32}$	$1\frac{1}{16}$
	96	99	$1\frac{1}{16}$	$1\frac{1}{16}$
9	96	96	$1\frac{1}{16}$	$1\frac{1}{16}$
	99	96	$1\frac{1}{32}$	$1\frac{1}{16}$
	96	96	$1\frac{3}{32}$	$1\frac{1}{32}$
7	97	96	$1\frac{1}{32}$	$1\frac{1}{16}$
	99	97	$1\frac{1}{16}$	$1\frac{1}{16}$
	98	97	$1\frac{1}{16}$	$1\frac{3}{32}$

[1] 100=M; 98=−M; 96=+SLM; 94=SLM.

Table 3.—Effect of two seed cotton drying systems on array measurements when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Upper quartile length		Mean length		Coefficient of variation	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Inches*		*Inches*		*Percent*	
13	1.19	1.18	0.98	0.96	30	31
11	1.17	1.16	.96	.95	31	32
9	1.15	1.16	.94	.95	31	31
7	1.17	1.18	.95	.96	31	32
	ANALYSIS OF VARIANCE[1]					
Variable						
Moisture	(**)		(*)		NS	
Drier	NS		NS		NS	
M x D	NS		NS		NS	
Moisture	(**)	(*)	NS	NS	NS	NS
Drier:						
13	NS		NS		NS	
11	NS		NS		NS	
9	NS		NS		NS	
7	NS		NS		NS	

[1] *=Significant at 5-percent level; **=significant at 1-percent level; NS=not significant.

Table 4.—Effect of two seed cotton drying systems on array-length groups when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Fibers shorter than ½ inch		Fibers ½ inch to 1 inch		Fibers 1 inch and longer	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Percent*		*Percent*		*Percent*	
13	8.6	9.8	33.6	36.3	57.9	54.0
11	10.3	10.4	35.0	35.8	54.7	53.9
9	10.4	10.4	36.3	35.6	53.3	53.9
7	10.1	10.5	35.6	35.1	54.3	54.5
	ANALYSIS OF VARIANCE [1]					
Variable						
Moisture	NS		NS		NS	
Drier	NS		NS		NS	
M x D	NS		NS		NS	
Moisture	(*)	NS	NS	NS	NS	NS
Drier:						
13	(**)		NS		NS	
11	NS		NS		NS	
9	NS		NS		NS	
7	NS		NS		NS	

[1] * = Significant at 5-percent level; ** = significant at 1-percent level; NS = not significant.

Table 5.—Effect of two seed cotton drying systems on fibrograph measurements when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Upper half mean length		Mean length		Uniformity ratio	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Inches*		*Inches*		*Percent*	
13	1.07	1.06	0.90	0.88	84	83
11	1.06	1.05	.88	.87	83	83
9	1.04	1.05	.87	.86	84	82
7	1.05	1.05	.87	.88	84	84
	ANALYSIS OF VARIANCE [1]					
Variable						
Moisture	(*)		NS		NS	
Drier	NS		NS		NS	
M x D	NS		NS		NS	
Moisture	(*)	NS	NS	NS	NS	NS
Drier:						
13	NS		NS		NS	
11	NS		NS		NS	
9	NS		NS		NS	
7	NS		NS		NS	

[1] *=Significant at 5-percent level; NS=not significant.

Table 6.—Effect of two seed cotton drying systems on Micronaire, Pressley "0" gage strength, total picker and card waste, and neps per 100 square inches of card web when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Micronaire		Pressley—"0" gage		Total picker and card waste		Neps per 100 square inches	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Reading*		*1000 p.s.i.*		*Percent*		*Number*	
13	4. 1	4. 2	89	90	4. 32	5. 67	12. 3	12. 3
11	4. 2	4. 1	91	90	3. 85	3. 86	11. 3	11. 3
9	4. 2	4. 1	90	92	3. 65	3. 71	11. 3	11. 7
7	4. 1	4. 1	91	91	3. 52	3. 55	11. 7	11. 3
	ANALYSIS OF VARIANCE [1]							
Variable								
Moisture	NS		NS		(**)		NS	
Drier	NS		NS		(**)		NS	
M x D	NS		NS		(**)		NS	
Moisture	(*)	NS	NS	NS	(**)	(**)	---	
Drier:								
13	NS		NS		(*)		---	
11	NS		NS		NS		---	
9	NS		NS		NS		---	
7	NS		NS		NS		---	

[1] *=Significant at 5-percent level; **=significant at 1-percent level; NS=not significant.

Table 7.—Effect of two seed cotton drying systems on break factor, yarn appearance, and ends down per 1,000 spindle hours when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Break factor		Yarn appearance		Spinning end breakage	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Index*		*Index*		*Number*	
13	2467	2419	111	114	61	87
11	2396	2365	112	113	62	74
9	2382	2410	111	111	56	63
7	2372	2401	111	113	63	63
	ANALYSIS OF VARIANCE [1]					
Variable						
Moisture	(**)		NS		NS	
Drier	NS		NS		(*)	
M x D	NS		NS		NS	
Moisture	(*)	NS	---		NS	(*)
Drier:						
13	NS		---		NS	
11	NS		---		NS	
9	NS		---		NS	
7	NS		---		NS	

[1] *=Significant at 5-percent level; **=significant at 1-percent level; NS=not significant.

Table 8.—Effect of two seed cotton drying systems on single strand strength, percent elongation, and strength coefficient of variation when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Single strand strength		Elongation		Strength coefficient of variation	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Grams*		*Percent*		*Percent*	
13	246. 5	243. 0	7. 4	7. 5	10. 3	10. 6
11	243. 2	243. 1	7. 5	7. 5	10. 0	10. 2
9	239. 4	245. 5	7. 4	7. 6	10. 5	11. 0
7	240. 7	247. 1	7. 5	7. 5	10. 8	10. 5
	ANALYSIS OF VARIANCE [1]					
Variable						
Moisture	NS		NS		NS	
Drier	NS		(**)		(**)	
M x D	NS		(*)		NS	
Moisture			NS	NS		
Drier:						
13			NS			
11			NS			
9			(*)			
7			NS			

[1] *=Significant at 5-percent level; **=significant at 1-percent level; NS=not significant.

Table 9.—Effect of two seed cotton drying systems on yarn imperfections per 1,000 yards when seed cotton was dried to 6 percent moisture from various levels of initial seed cotton moisture, Series C cotton

Initial lint moisture	Neps/1,000 yards		Thick places/ 1,000 yards		Thin places/ 1,000 yards		Irregularity coefficient of variation	
	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier	Experimental drier	Commercial drier
Percent	*Number*		*Number*		*Number*		*Percent*	
13	370	347	972	907	451	490	20. 8	20. 8
11	376	336	977	924	411	443	21. 2	21. 0
9	414	353	1008	900	476	378	21. 4	20. 9
7	401	349	997	885	456	396	21. 2	20. 8
	ANALYSIS OF VARIANCE [1]							
Variable								
Moisture	NS		NS		NS		NS	
Drier	(**)		(**)		NS		(*)	
M x D	NS		NS		NS		NS	
Moisture								
Drier:								
13								
11								
9								
7								

[1] *=Significant at 5-percent level; **=significant at 1-percent level; NS=not significant.

Table 10.—Effect of two cotton-drying systems on certain fiber properties, Series M cotton [1]

	Experimental drier	Commercial drier
Suter-Webb array:		
U.Q.L. .... inches	1.17	1.16
Mean length .... do	.95	.95
C.V .... percent	31	31
Fibers shorter than ½ inch .... percent	9.9	9.7
Fibers ½ inch to 1 inch .... do	36.8	37.8
Fibers 1 inch and longer .... do	53.3	52.4
Fibrograph (Servo):		
U.H.M .... inches	1.04	1.04
Mean length .... do	.88	.87
Uniformity ratio .... percent	84	84
Micronaire .... reading	4.0	4.0
Pressley "0" gage .... p.s.i	89	89

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[1] None of the comparisons were significant at the 5-percent level.

Table 11.—Effect of two cotton-drying systems on grade index, staple length, manufacturing properties, and yarn properties, Series M cotton [1]

	Experimental drier	Commercial drier
Grade index [2]	97.0	96.0
Staple length .... inches	$1\frac{1}{16}$	$1\frac{3}{32}$
Total picker and card waste	**3.89	**4.02
Neps/100 square inches	*11.9	*11.0
Actual EDMSH	42	46
Corrected EDMSH	42	45
Break factor	2355	2368
Yarn appearance index	*106	*109
Uster measurements:		
Single strand strength .... grams	238.0	238.3
Percent elongation	7.3	7.4
Strength C.V .... percent	10.2	10.3
Neps/1,000 yards	**352	**298
Thick places/1,000 yards	949	902
Thin places/1,000 yards	374	394
C.V .... percent	20.2	20.2

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[1] *Significant at 5-percent level; **significant at 1-percent level.

[2] Classing was performed by a commercial cotton company: 100=M; 98=−M; 96=+SLM; 94=SLM.

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